Teaching Statement

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I think of teaching, like writing and oral presentations, to be an important part of my research rather than a distraction from it. Careful, empathetic exposition of complex ideas is, of course, necessary for reasearch to reach a wide audience. But, even more, the very act of teaching well forces the teacher to refine and examing their ideas. The benefits of thoughtful teaching are particularly great in a field like statistics, where it can be much harder to truly understand the fundamental concepts (hypothesis testing, Bayes rule, randomness in the real world) than it is to simply mechanically apply the mathematical tools of the trade.

Accordingly, I have had a lifelong passion for teaching. In addition to working as a university-level teaching assistant both as an undergraduate in engineering and as a doctoral student in statistics (for which I received a university teaching award), I was a full-time teacher for two years at the middle and elemenatary school level as a Peace Corps volunteer in Kazakhstan teaching math and ESL. During the Peace Corps, I also wrote a textbook and organized and participated multiple extracurricular classes for my community, in math, music, and in pedagogy itself for Kazakhstani teachers of ESL. As a PhD student, I volunteered for a year and a half teaching math courses to inmates at San Quentin prison with the Prison University Project.

Many of my extra-curricular activities, though not explicitly in a classroom, have had a teaching component. I have acted as a formal and informal mentor to numerous PhD students, both as part of the student mentorship program at UC Berkeley and as a postdoctoral researcher at MIT. At Google, I acted as an official mentor for several junior engineers. For most of my PhD, I organized and conducted my own reading group for any interested students on topics including variational Bayes, Bayesian nonparametrics, differential geometry, the bootstrap, and functional analysis. Consulting often has a pedagogical component to it; I participated in the UC Berkeley statitsical consulting class, provided statistical consulting as a fellow in the Berkeley Institute of Data Science, and consulted professionally, including participating for several years in Berkeley's chapter of the National Security Agency Statistical Advising Group.

Good teaching is an art that is never perfected. Over the years I have made many missteps, learned from at least some of my mistakes, and will continue to learn for the rest of my life. For the remainder of the essay, I will discuss some principles that I have come to believe make for good teaching and a little bit

about the context.

1 Motivate the students

During my second year as a PhD student at UC Berkeley I was asked by Prof. Bin Yu to be her teaching assistant for the graduate-level course in applied statistics. The course was organized around a number labs using real-life datasets, and my reponsibilties were to give weekly lectures, hold office hours, and grade the written labs. In addition, Prof. Yu asked me to add a reproducible research component to the course based on my experience at Google, to which end I incorporated Github, code readbility, and unit testing into the lab requirements.

I quickly realized that simply teaching code readability and making it a component of the grade was insufficient. At Google, you cannot submit changes that violate readability standards, but, in the class, not a single student was carefully following readability guidelines in their submitted code. The students — who were otherwise very highly motivated — simply did not see the importance of readability enough to change bad habits. To address this, I designed an in-class exercise in which the students had to "reproduce" a simple analysis written by me. In my code, I deliberately and systematically violated all the code readbility guidelines I was trying to teach and, as a result, it was quite difficult to understand what my analysis was doing. To sweeten the pot, I put a small but meaningful error in the code and challenged the students to find it. The students loved the puzzle-solving aspect of the assignment and, to my delight, spent much of the hour complaining about my terrible style. Following this assignment, the labs' code readability improved considerably.

Students, like all humans, love games and puzzles, and as long as the pedagogical goal is served, I try to emphasize the game or puzzle aspect of a problem whenever possible. For example, oral production and comprehension of mathematical concpets was a cornerstone of my seventh grade ESL lesson plan in Kazakhstan. I designed a game in which students in teams would read or describe mathematical formulas or figures to a teammate, who had to understand their description and transcribe the result on the board. The game relied directly on core skills, was built entirely around interactions between students, could be tuned to be as hard or as easy as was required, and usually produced a little bit of shouting chaos that middle schoolers love.

I learned early that it is important to be the teacher the students want, not the teacher you would have wanted. My first official teaching position was as an undergraduate at UIUC, when I was offered the chance to act as a teaching assistant for the core statics class in the school of engineering. My responsibilities included a weekly lecture, grading, and office hours. At the time, I was particularly excited about axiomatic thinking, and designed all my lectures around this fascination, re-presenting the course material with an emphasis on assumptions and consequences. Sadly, I was not then in the habit of getting regular feedback from my students, and didn't realize until much later how little the students shared my interest. They felt that the course material was rigorous

enough as is, and wanted context, motivation, and intuition from me. My course evaulations were poor, but I resolved to put the students' needs before my own the next time around.

That said, however, being genuinely passionate about the subject material can be extremely motivating for students. Enthusiasm is infectious, and enthusiastic students learn the best. Whatever my shortcomings as a teacher, one cannot deny my enthusiasm. Thanks, maybe, to my theater background (I acted and directed theater for many years through high school and college), I am confident in front of a crowd, and able to bring a lot of physical energy into a classroom. In Kazakhstan, I organized an English-language math club for anyone from the community who was intersted, and I always drew a surprisingly large and diverse crowd. At one point we were talking about what topics to discuss next and I started asking the attendees why they were so interested in math club, and one (himself a volunteer math teacher from Turkey) answered, generously, "We come to be with you."

2 Have a plan and check it regularly

Other than the Kazakh language, my Peace Corps in-country training was all about pedagogy, and the cornerstone of the pedagogical curriculum was lesson planning. Just as good expository writing has structure at many levels, a well-designed class benefits from a relatively small number of articulable high-level goals, with explicit connections to individual topics, which are made concrete in daily lesson plans. A clear plan helps the teacher remember what is essential and what can be elided, and helps to motivate learning.

Only slightly less important than having a plan is knowing when to deviate from it. It is imperative for a teacher to regularly and meaningfully evaluate whether the students are aquiring the skills they need to aquire to progress in the curriculum. Perhaps ironically, evaluation is extra important at the university level, where imposter's syndrome is an epidemic and students are highly motivated to give the appearance of understanding, whether or not they do.

I find it useful to evaluate using many modalities, both to give students the best chance to shine and to give myself the best chance of discovering shortcomings. For example, most techincal lectures have many points at which minor inferential steps can be made into a short, minute-long exercise. Explicitly pausing and then giving a quieter student the chance to fill in a step both requires the students to remain actively engaged and can reveal if the exposition is going too quickly. (When teaching younger students, I like to warn them that I will make a mistake in the next five minutes, and challenge them to detect it.) Homework, of course, has some value, but it is most valuable when it requires the students to use concepts creatively, otherwise even highly motivated students may copy from the book or form others out of fear born of the imposter's syndrome. I find short, low-stakes, written in-class quizzes at the beginning of class to be particularly effective at checking in on students. I also like to use

small group work, both because it gives the opportunity for weaker students to learn from stronger ones and because I can learn a lot by walking around and listening to the conversation. Relatedly, it can be wonderful to have students evaluate each others' work, either in the form of oral or written presentations; typically the teacher can learn a lot about the students' state of mind both from the presentation and the feedback.

In my experience, one consequence of good evaluations in a math classroom is seeing clearly that typical classrooms have a wide range of abilities, which helps the teacher see the importance of designing a classroom that accomodates different levels. For example, I taught an introductory statistics class at San Quentin University through the Prison University Project (PUP). The students were all excited to learn but came from vastly different math backgrounds — some had been top students when they were younger, some had only learned to read as adults through PUP. To help accomodate the range of abilities and needs, I reduced the proportion of the class devoted to lectures and increased the time available for individual or group work while I walked around and answered questions. I would designed the problem sets with the expectation that *no* student would be able to complete the whole thing in the time allotted, so that the faster students could quickly proceed to more challenging problems, and the slower students could spend more time at their level. When I found the same question was being asked repeatedly, I would bring everyone together for a brief lecture on the question, and then return to individual work.

The primary purpose of evaluation, it must be remembered, is to give and get useful feedback, and to motivate the students to stay engaged. It is not to sort students into wheat and chaff, and must not be presented that way. If nothing else, such a culture of intimidation and evaluation makes it more difficult for a teacher to get the feedback they need to improve their lesson plans. It is true that, at the end of the day, we often have to give students meaningful grades which have an evaluative component. To my mind this is, at best, a necessary evil. In order to render final grades as fair and useful as possible, I always work to make the standards for the final grades as clear and open, to allow students to continuously monitor their grade, to communicate with struggling students precisely what they need to do to improve their grade, and to reduce, as much as possible, large, high-stakes assignments such as final exams.

3 Notes

Stories I want to tell:

X Motivating code cleanliness in STAT215A

X Oral comprehension game for 7A

X Introduction to statics and axiomatic thinking

X Lesson planning and keeping the class on track (PUP stats going too fast, econ student talking about philosophy in a stats class, ESL story time)

X Clear expectations (compare materials course vs 210A as writing classes)

X Getting regular feedback on student progress (PUP, ESL)

X Teaching for a range of abilities (open ended problem sets)
Include anecdotes from other teaching things (consulting, &c)?